



Armed Forces College of Medicine

AFCM



Pathology of bone tumors (1)



By the end of this lecture the student will be able to:

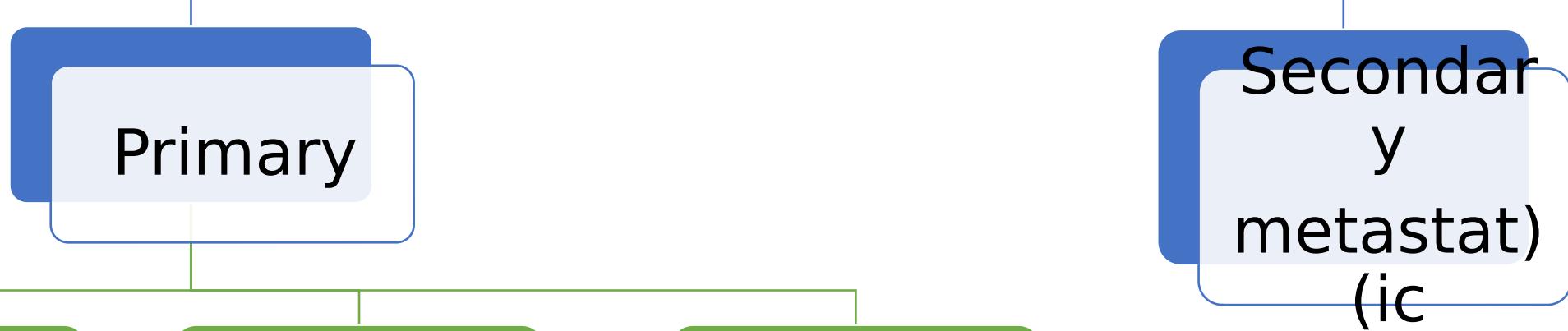
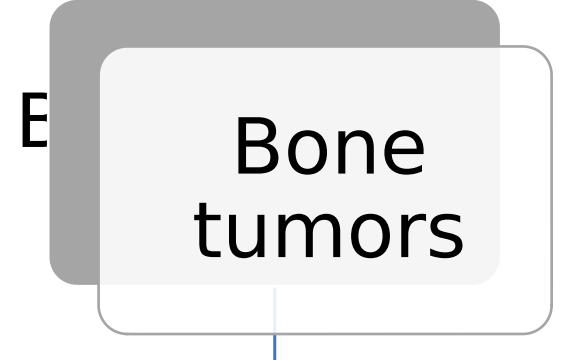
1. Classify bone tumors & enumerate them.
2. Enumerate benign bone tumors
3. Discuss pathology of compact osteoma & osteoid osteoma
4. Describe pathology of benign cartilage forming tumors
5. Describe the pathology of giant cell tumor of bone.
6. Mention the radiologic findings of giant cell tumor.

Lecture Plan



- 1. Part 1 (5 min) Introduction**
- 2. Part 2 (35 min) Main lecture**
- 3. Part 3 (5 min) Summary**
- 4. Lecture Quiz (5 min)**

Bone Tumors



Benign

Locally aggressive

Malignant

TUMORS OF BONE



BENIGN

**Osteoma &
osteoblastoma**

**Osteochondroma
(exostosis)**

Chondroma

Chondroblastoma

Chondromyxoid fibroma

Fibroma

Others: hemangioma

LOCALLY MALIGNANT

Giant cell tumor
**Adamantinoma
(Ameloblastoma)**
Chordoma

MALIGNANT

OSTEOSARCOMA
Chondrosarcoma
Fibrosarcoma
Ewing's sarcoma
**Plasma cell
neoplasms**

Benign bone tumors



Osteoma

- ❖ **Compact osteoma.**
- ❖ **Osteoid osteoma and**
- ❖ **Osteoblastoma**

Compact Osteoma

Site: Flat bones of the skull and face.

Gross: A hemispherical, non capsulated, hard, ivory like mass.

Microscopic:

Well-differentiated mature lamellar bony trabeculae separated by fibrovascular tissue.

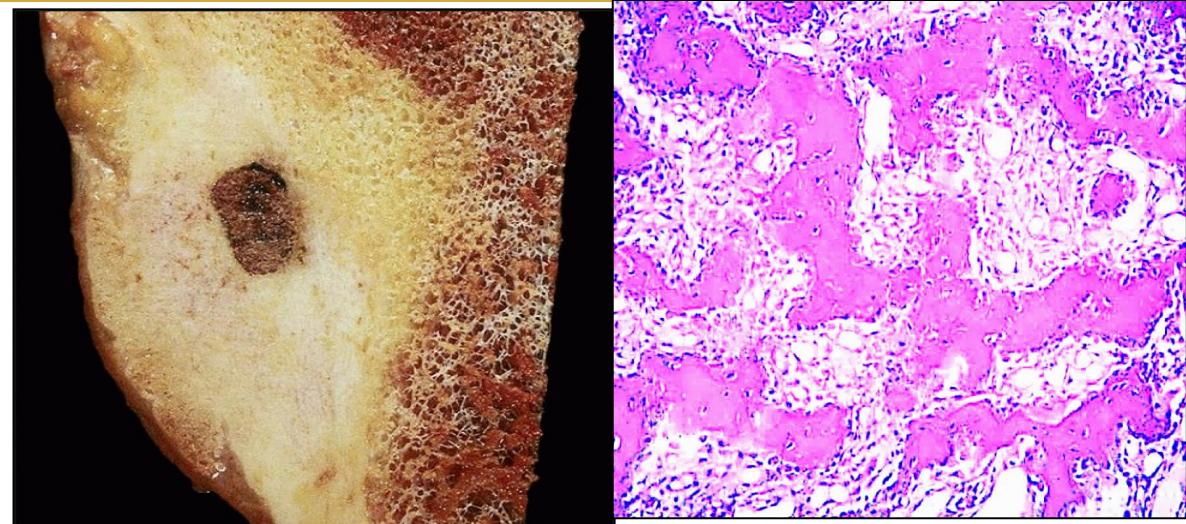


Osteoid Osteoma

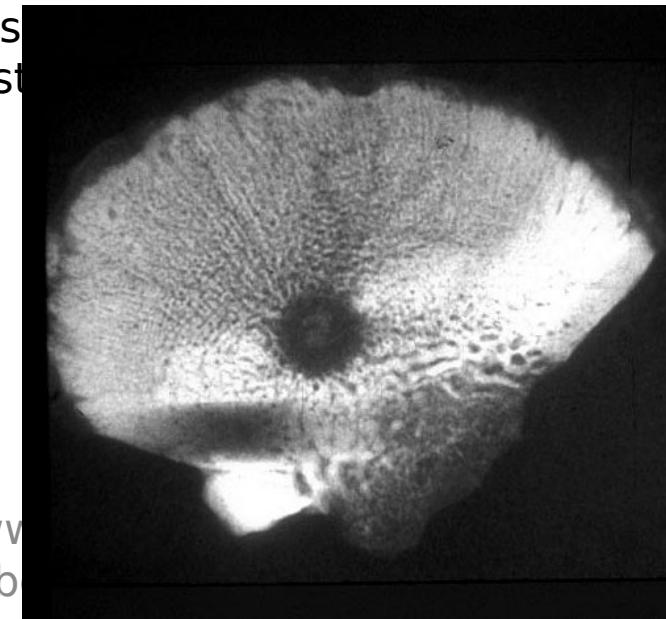
CP:

- ❖ The tumor is associated with nocturnal pain, due to production of prostaglandin E2, by proliferating osteoblasts.
- ❖ The pain is markedly improved by salicylates .

Key: A radiolucent



<https://bas...osteoid-ost...>



<http://www...b...>

Osteoid Osteoma



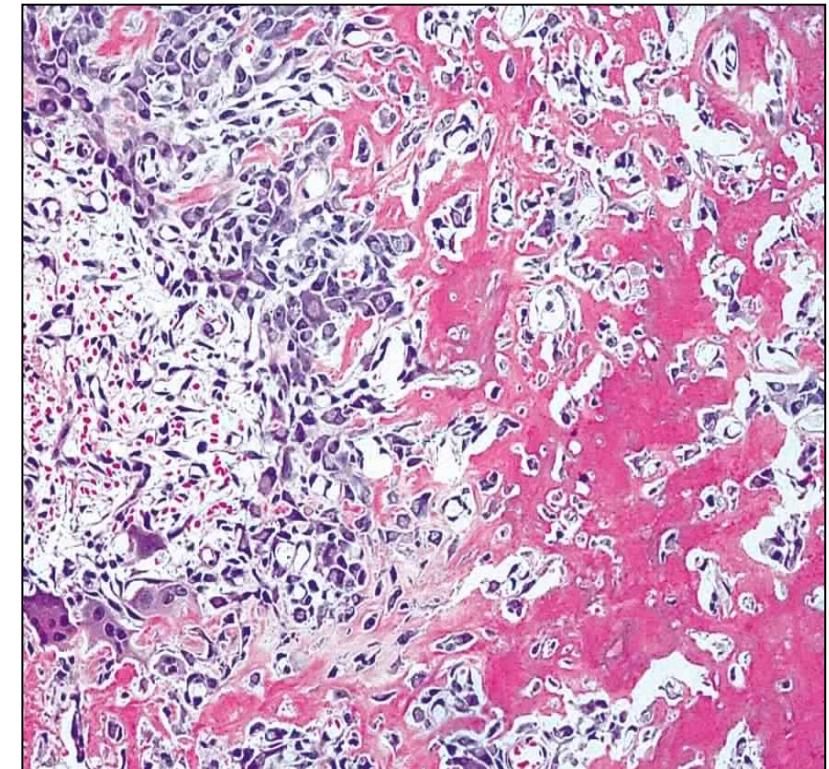
- ❖ **Size:** Small (usually less than 1cm).
- ❖ **Site:** The diaphysis of a long bone, often the tibia or femur.
- ❖ **Gross:** A well defined, gritty & friable.
- ❖ **Mic:** Trabeculae of osteoid woven bone, surrounded by sclerotic bone formation.



Osteoblastoma



- *It is similar to an osteoid Osteoma but*
 - * Larger (>2 cm).
 - * Often involves vertebrae.



<http://www.pathologyoutlines.com/topic/boneosteoblastoma.html>

BENIGN CARTILAGE-FORMING TUMOURS (CHONDRONECTIC)



- 1-Osteocartilaginous Exostoses
(Osteochondromas)
- 2- Enchondroma

Osteocartilaginous Exostoses (Osteochondromas)



- ❖ It is not a true tumor but regarded as a disorder of growth & development.
- ❖ It originates from aberrant lateral growth of epiphyseal growth plate .
- ❖ **Incidence:**
- ❖ They are the commonest of benign cartilage-forming lesions.



<https://www.youtube.com/watch?v=94hmcpM24aA>

<https://radiopaedia.org/cases/osteochondroma-13>

Osteocartilaginous Exostoses (Osteochondromas)



- ❖ **No:** *single or multiple* .
- ❖ **Size:** Small (usually < than 1 cm).
- ❖ **Site:**
Metaphysis of long bones, most commonly lower femur and upper tibia (i.e. around knee) .



Osteocartilaginous Exostoses (Osteochondromas)



- ❖ ***Gross:***
Mushroom-shaped, cartilage-capped lesions.
- ❖ ***Mic:***
- ❖ *Outer cap composed of mature cartilage
- ❖ *Inner mature lamellar bone and bone marrow.
- ❖ ***Clinical picture:*** Asymptomatic, pain, deformity, or undergo malignant transformation (rare)



<https://emedicine.medscape.com/article/1256477-workup>





Enchondroma

- ❖ **Enchondroma:** It is a benign cartilage-forming tumour that develops within the medullary cavity of bone.
- ❖ **Site:** Mostly the short tubular bones of the hands and feet.
- ❖ **Clinical picture:** Usually asymptomatic.
- ❖ **Complication:** transformation into malignant chondrosarcoma, which is



<http://www.texasfootdoctor.org/enchondroma>

Enchondroma



No:

**Single or multiple
(*enchondromatosis*).**

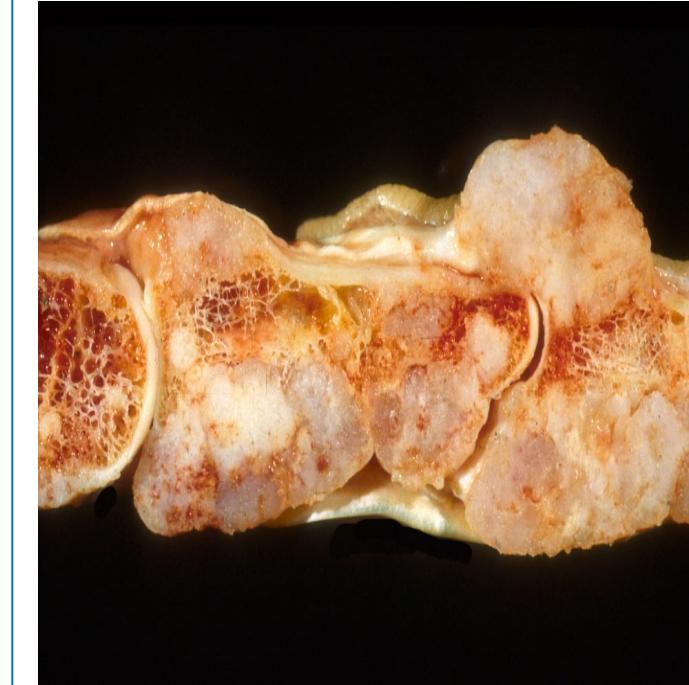
➤ **Maffucci's syndrome:** Multiple enchondromas with multiple soft tissue haemangiomas.

Gross:

A lobulated, bluish-grey, translucent, cartilaginous mass.

Mic:

Normal adult hyaline cartilage separated by fibro-vascular stroma.



<http://www.pathologyoutlines.com/topic/bonechondromaenchondromaslongbones.html>

TUMORS OF BONE



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LOCALLY MALIGNANT

- 1-Giant cell tumor**
- 2- Adamantinoma (Ameloblastoma)**
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MALIGNANT

OSTEOSARCOMA

Chondrosarcoma

Fibrosarcoma

Ewing's sarcoma

Plasma cell neoplasms

Giant cell tumor (osteoclastoma)



❖ Age:

- Usually after the age of 20 years but may occur in younger ages.
- Most giant cell tumors are locally malignant.
- Few cases (10-20%) are malignant and metastasize.

❖ Site:

- Around the knee joint (distal femur , proximal tibia)
- Both epiphysis and metaphysis



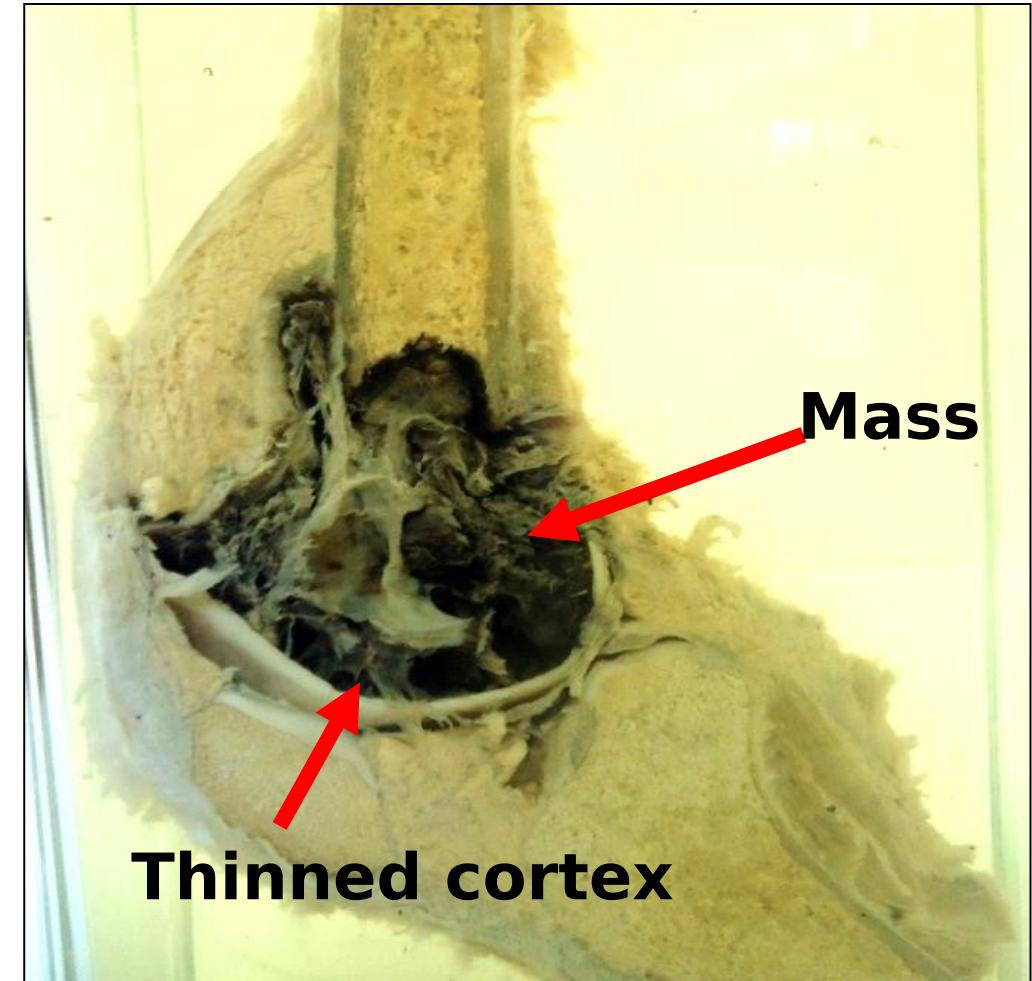
<https://www.youtube.com/watch?v=hY08PVkqPrg>

Giant cell tumor (osteoclastoma)



Gross:

- ❖ An eccentric mass that erodes subchondral bone
- ❖ The tumor tissue is grayish brown with cystic degeneration filled with hemorrhage.
- ❖ The covering cortical bone becomes markedly thinned (egg shell-like).

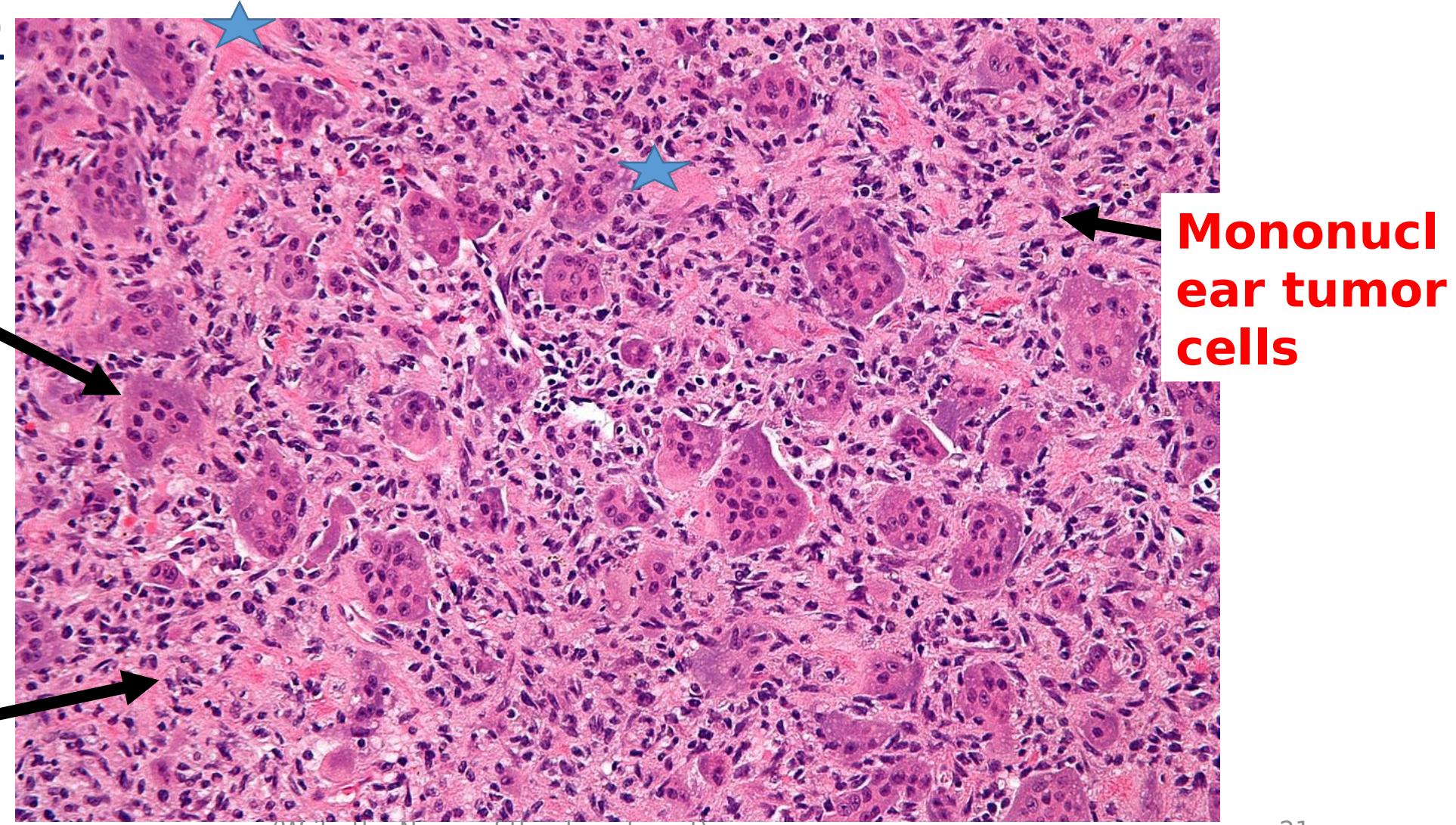


Giant cell tumor (osteoclastoma)



Microscopic ic:

Multinucleated giant cells



Giant Cell Tumor Of Bone (OSTEOCLASTOMA)



Microscopic:

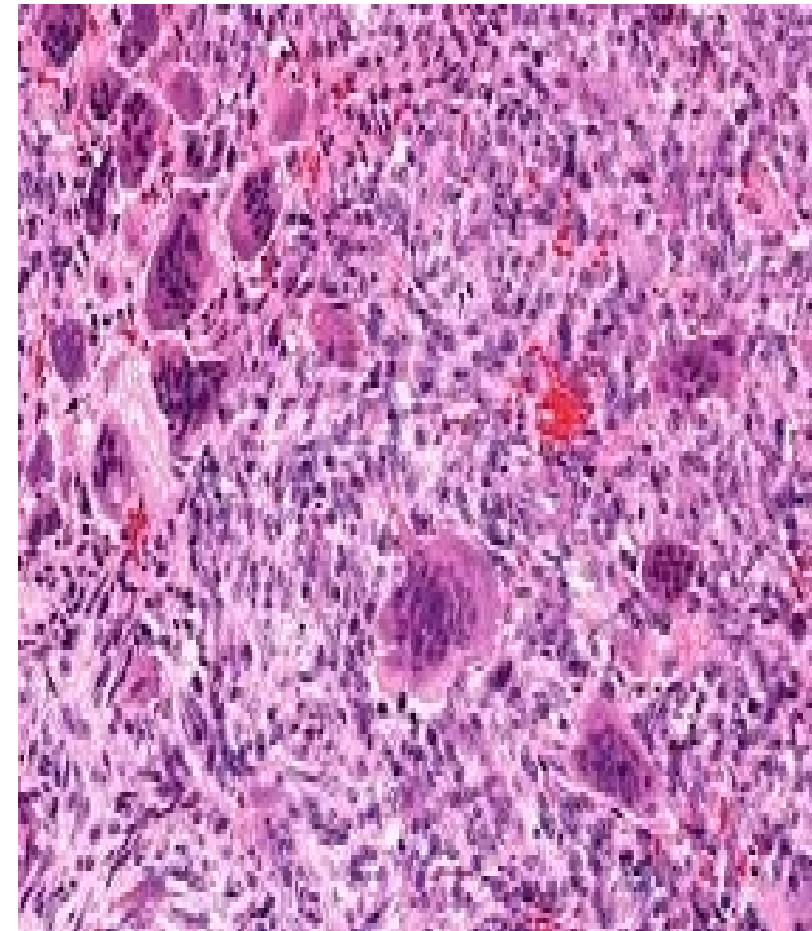
1. Neoplastic cells:

Oval mononuclear stromal cells, dark nuclei with variable atypia.

2. Non neoplastic cells:

Multinucleated giant cells; osteoclastic type, containing up to 100 nuclei.

3. Stroma: Collagenous, proliferated vessels with areas of hemorrhage.

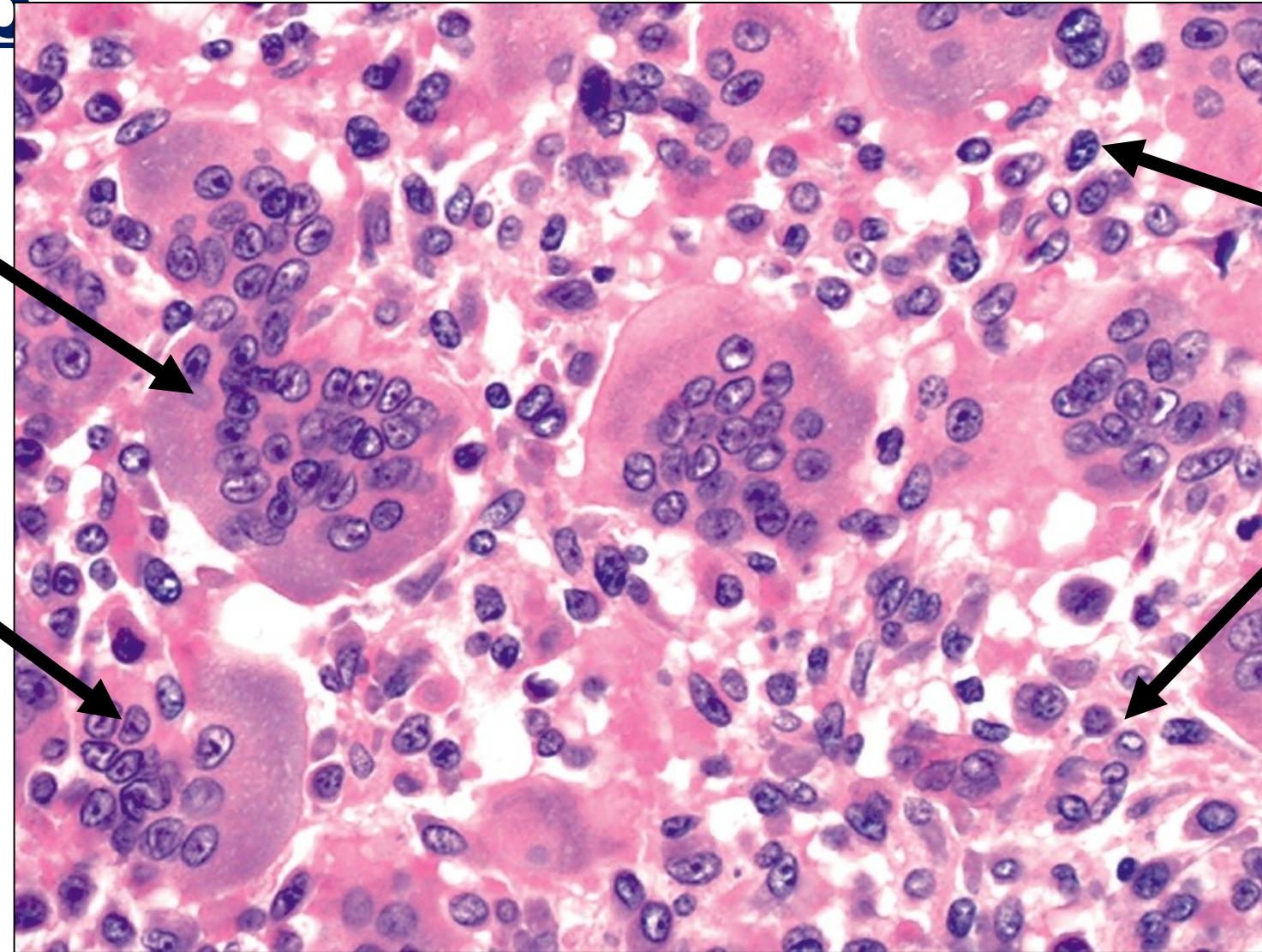


Giant cell tumor (osteoclastoma)



Microscopic ic:

Multinucleate
d giant cells
(up to 100
nuclei)
(osteoclastic
type) **NON-**
NEOPLAST
IC (fusion of
monocytes-
macrophages
)

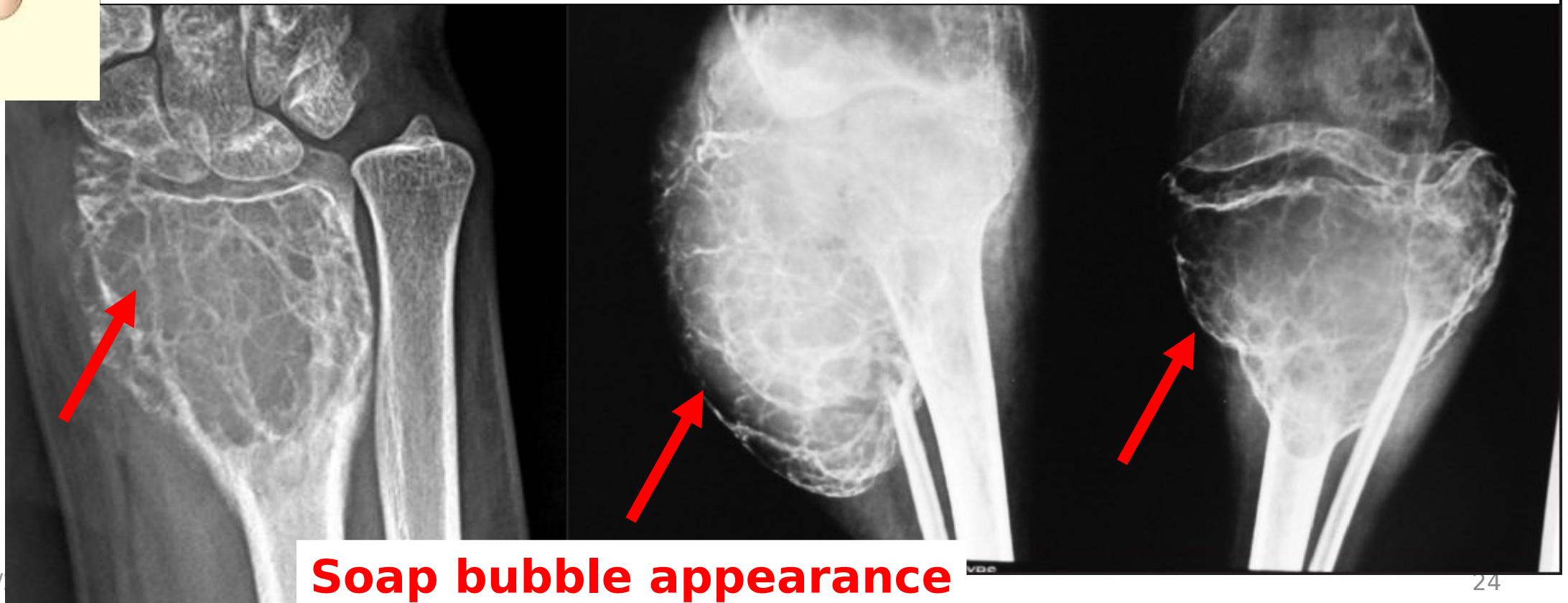


Neoplastic
Stromal
mononuclea
r **TUMOR**
CELLS
Oval,
mononuclea
r, dark
nuclei with
atypia

Giant cell tumor (osteoclastoma)



Eccentric osteolytic lesion with an adjacent thinned cortex and with no periosteal reaction (soap bubble like).



Giant cell tumor (osteoclastoma)



Spread:

- ❖ 80-90% of cases spread **locally**.
- ❖ The remaining cases may have a malignant behaviour and metastasize by blood.

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2-Chondrosarcoma
3-Fibrosarcoma
4-Ewing's sarcoma
5-Plasma cell neoplasms

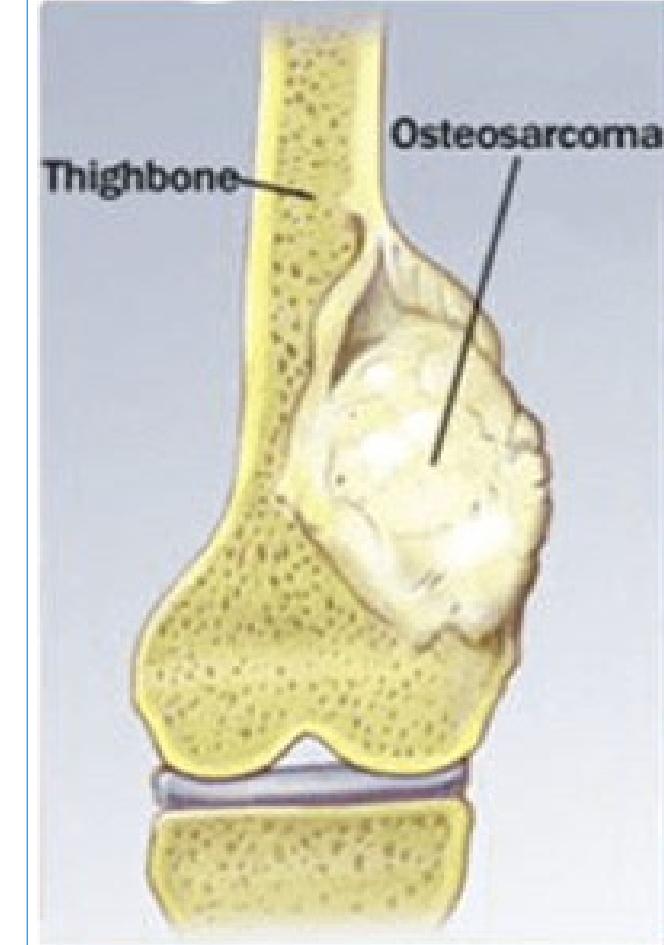
OSTEOSARCOMA (Osteogenic sarcoma) -1



- It is the most common primary malignant tumor of bone.
- The neoplastic cells are osteogenic □ secrete bone matrix (osteoid and/or osseous tissue).

Predisposing Factors:

1. Trauma.
2. Irradiation.
3. Paget's disease of bone.
4. Fibrous dysplasia.



Osteosarcoma

OSTEOSARCOMA (Osteogenic sarcoma) -1

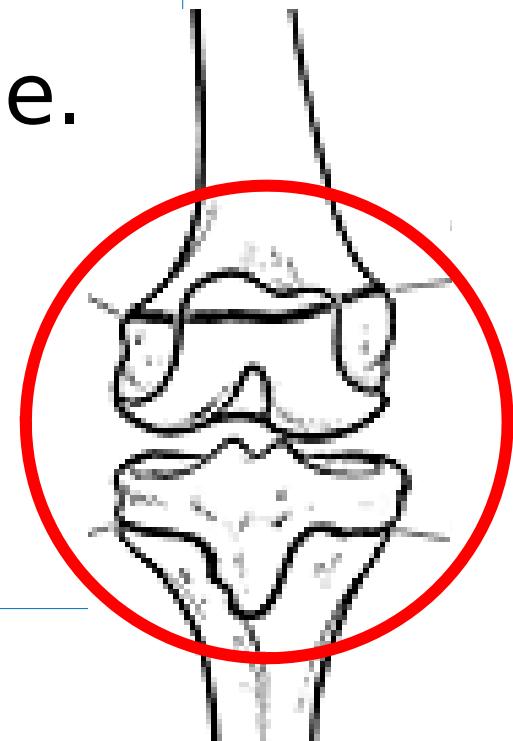


❖ **Age:**

- Children and young adults, usually **below 20 years.**
- In the elderly on top of Paget's disease.

❖ **Sites:**

- Distal femur and proximal tibia
- Starts within the **metaphysis**



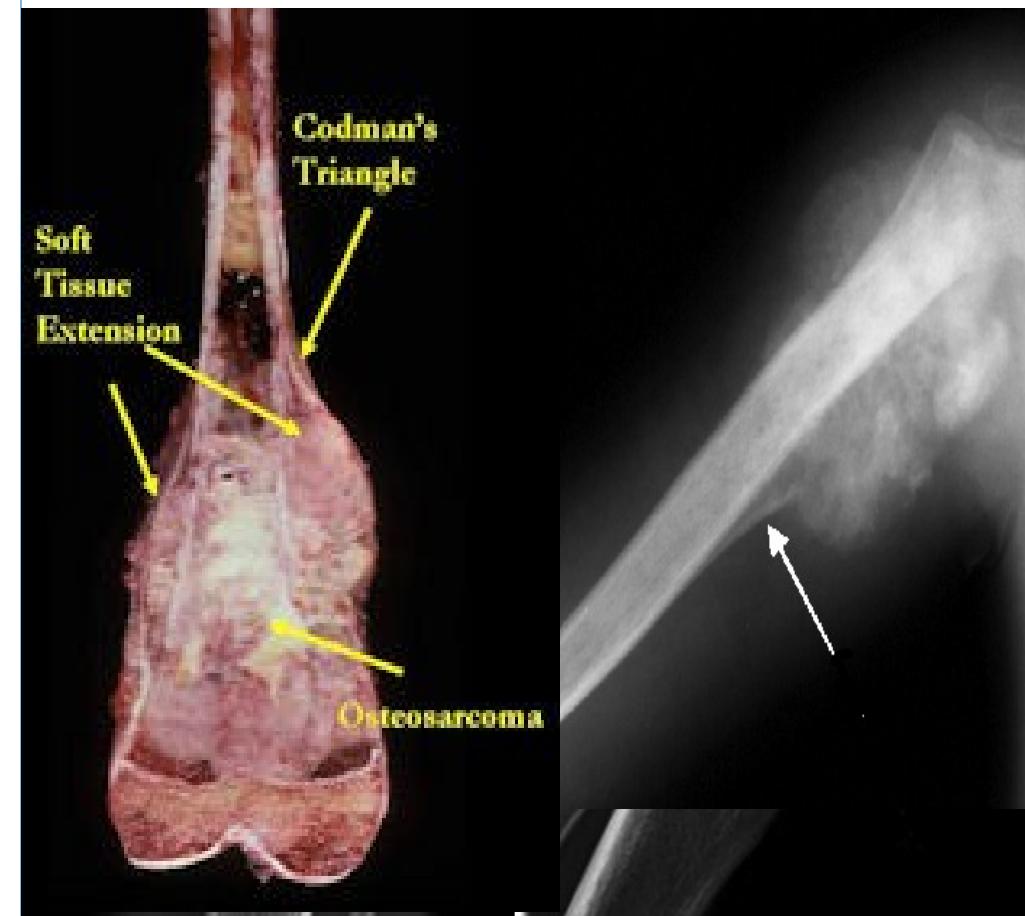
OSTEOSARCOMA (Osteogenic sarcoma) -1



Radiological Features:

1. Tumors rich in bone matrix may exhibit Sun ray appearance in X ray films.

2. Periosteal elevation may be associated with reactive periosteal bone formation in the triangle between the cortex and elevated periosteum. This can be





OSTEOSARCOMA (Osteogenic sarcoma) -1

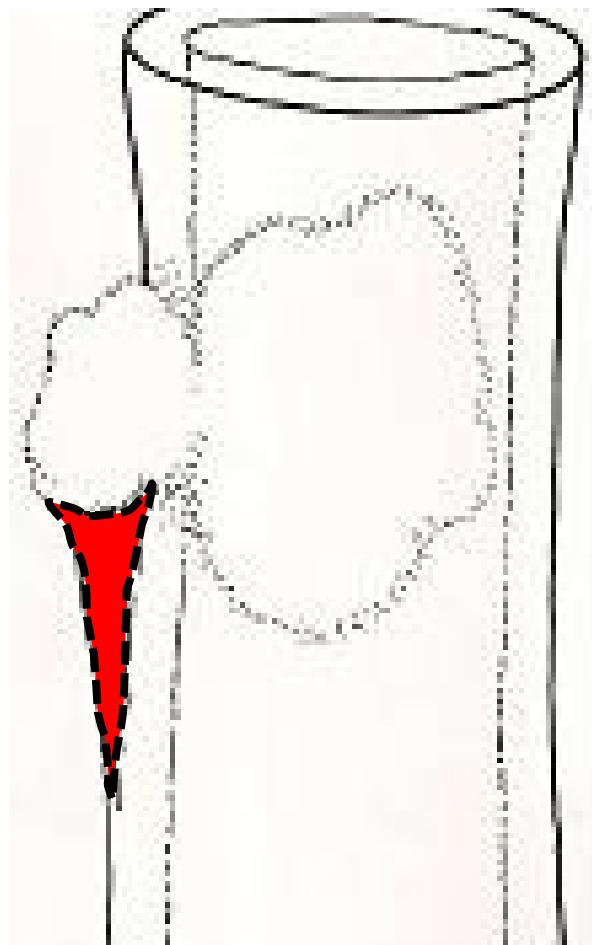


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Sun-ray



OSTEOSARCOMA (Osteogenic sarcoma) -1



**Codman's
triangle**



Codman triangle

Department of Pathology

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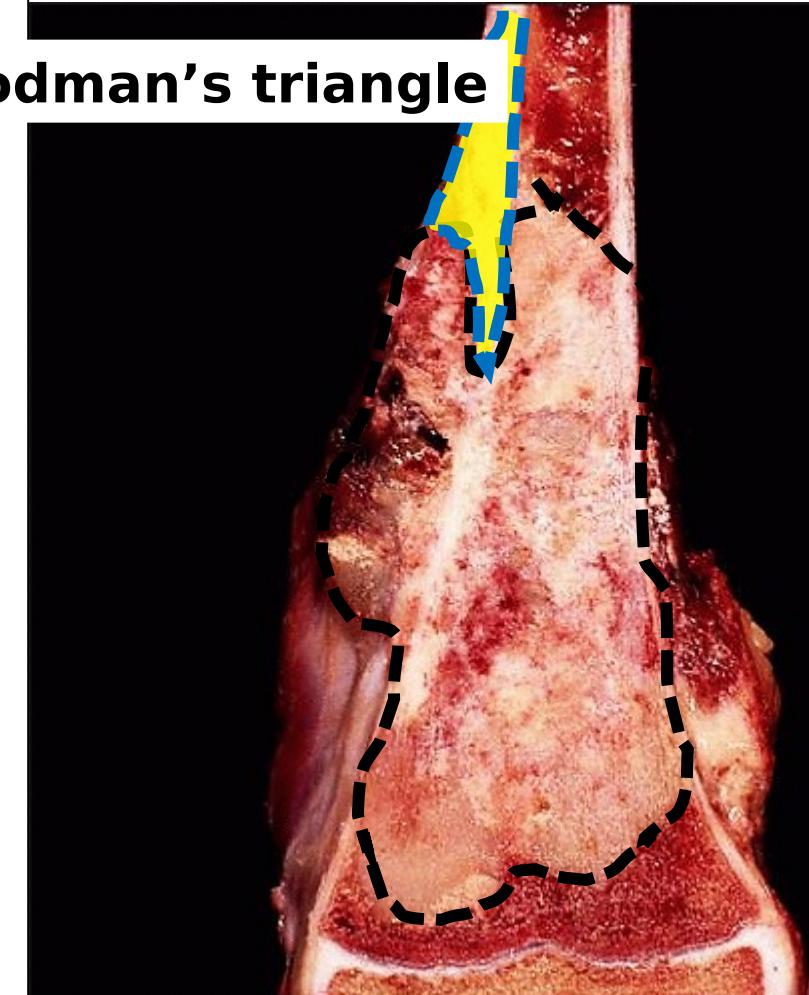
OSTEOSARCOMA (Osteogenic sarcoma) -1



Gross:

- ❖ Large mass within the **medullary canal** and destroys the bone cortex.
- ❖ The **periosteum** is elevated ☐ penetrated ☐ extension adjacent soft tissue.
- ❖ Hemorrhage and necrosis are usually extensive.
- ❖ **Osteosclerotic** or **Osteolytic** according to the degree of

Codman's triangle





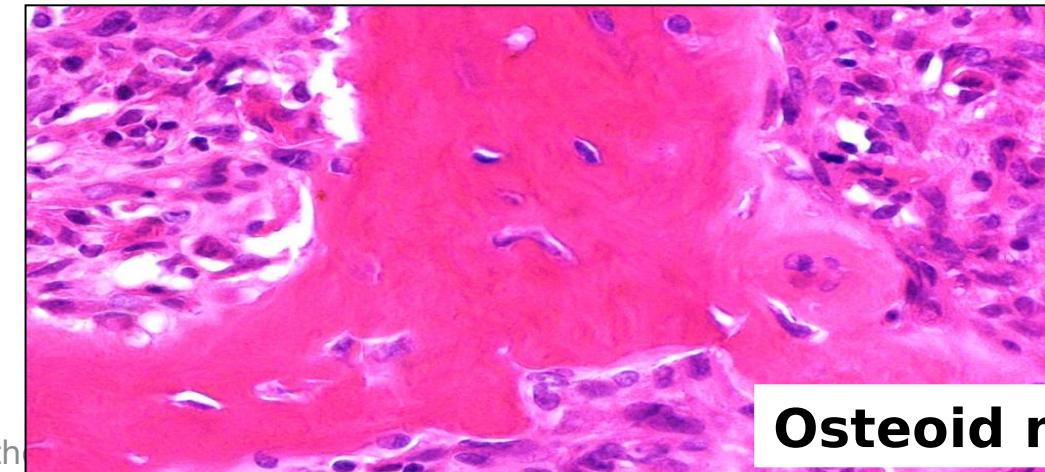
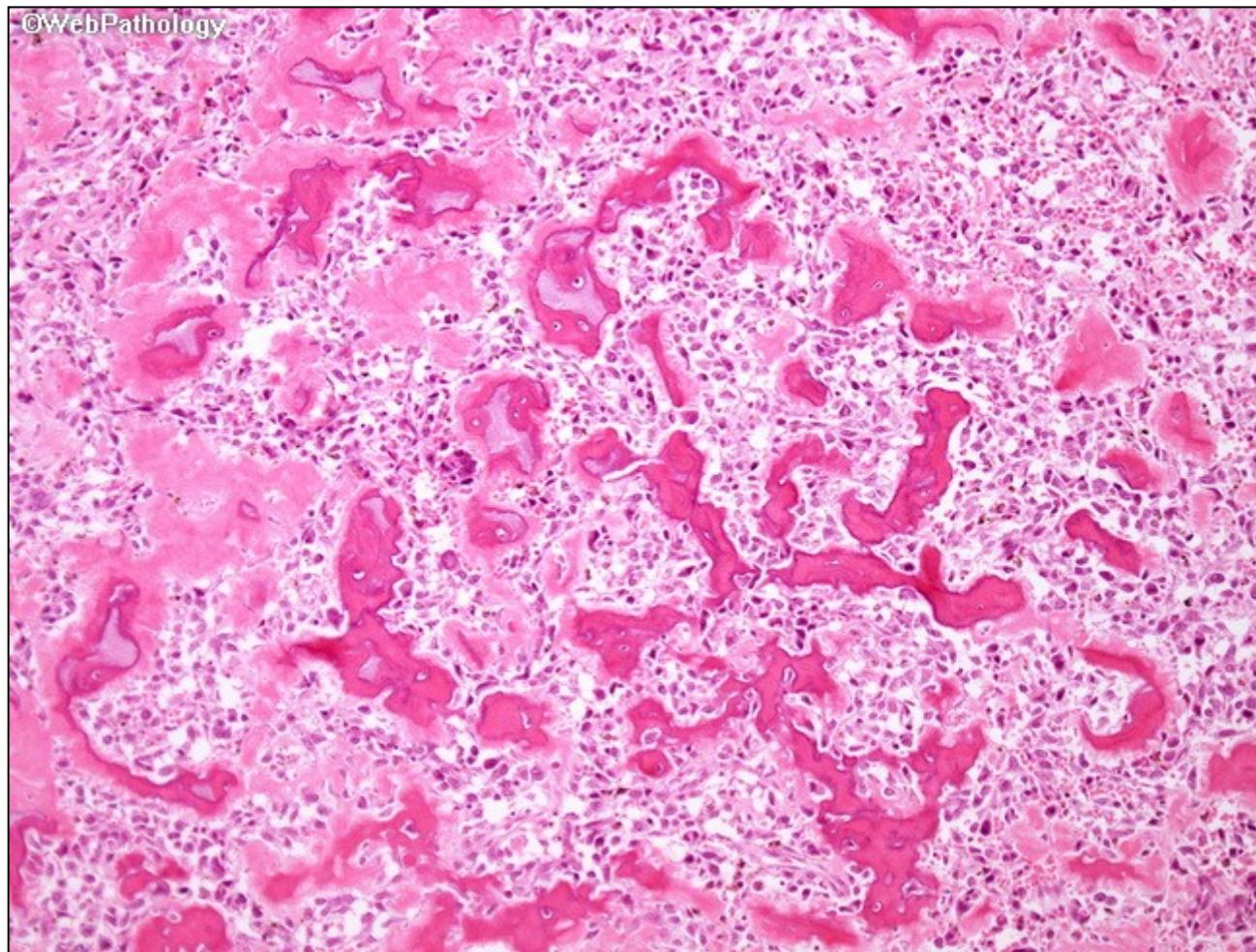
OSTEOSARCOMA (Osteogenic sarcoma) -1

Microscopic:

1. **Tumor cells**: Pleomorphic (spindle cells) with large dark nuclei and abnormal mitotic activity.
2. **Matrix** : Osteoid tissue (prominent in better differentiated tumors, minimal in poorly differentiated tumors).
3. **Thin-walled vessels** are present
4. Areas of necrosis and hemorrhage are frequent.



OSTEOSARCOMA (Osteogenic sarcoma) -1





OSTEOSARCOMA (Osteogenic sarcoma) -1

❖ **Spread:**

- Directly surrounding soft tissue
- Blood spread to lung and other sites

❖ **Prognosis:**

Highly malignant tumor → rapid spread and poor prognosis



Lecture Quiz



A 15 years old male, presented with pain and swelling around his left knee joint that started few weeks ago. X-ray was done and revealed an osteolytic metaphyseal mass lesion with adjacent periosteal elevation and subperiosteal triangular reaction. **A biopsy from this lesion will reveal:**

- A. Islands of epithelium in a fibrous stroma.
- B. Multinucleated giant cells, round cells and fibrous stroma
- C. Increased number of lymphocytes and plasma cells
- D. Pleomorphic spindle cells and osteoid matrix
- E. Large amount of osteoid matrix and benign fibroblasts

Lecture Quiz



A growth arises in the upper tibia, grossly appearing as a mushroom shaped mass:

- a. This is a benign tumor.
- b. It arises also in skull bones.
- c. It originates from medullary canal.
- d. Is called exostosis.
- e. Spreads by blood

SUGGESTED TEXTBOOKS



1. Robbins basic pathology, ninth Edition
2. Kaplan step 1 pathology lecture notes 2017 (P.78-98)